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ABSTRACT

This qualitative research studied patterns of student self-talk (thought) in a sixth-grade mathematics classroom. The research sought greater understanding of the mental labels and operative cognitive structures upon which students rely in order to participate in schoolwork. Twenty-four students were given "math journals" and asked to record their thoughts and feelings as they occurred in class over a six-week period. Results supported a collective group-dynamics theoretical framework; 92% of recorded student self-talk seemed to assess either the threat/difficulty/danger facing the student group, the students' positions within the group, or the performance of the group "leader" (the teacher). These results may also support a socio-biological interpretation of student thought patterns, suggesting the possible existence of deeply imprinted habits of cognition which could have potentially important instructional implications. (Author/GCP)

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SIXTH-GRADE STUDENT SELF-TALK: INDIVIDUAL THOUGHT, COLLECTIVE MIND

A. ABSTRACT

This qualitative research studied patterns of student self-talk (thought) in a sixth-grade mathematics classroom. 24 students were given "math journals" and asked to record their thoughts and feelings as they occurred in class over a six-week period. Results supported a collective group-dynamics theoretical framework; 92% of recorded student self-talk seemed to assess either the threat/difficulty/danger facing the student group, the students' positions within the group, or the performance of the group "leader" (the teacher). These results may also support a socio-biological interpretation of student thought patterns, suggesting the possible existence of deeply imprinted habits of cognition which could have potentially important instructional implications.

B. INTRODUCTION

This research seeks greater understanding of the operative cognitive structures upon which students rely in order to participate in schoolwork. Essentially, the questions are: a) "What does student self-talk consist of?" b) "What are the heuristics governing their thinking processes and work output?" and c) "Could a better understanding of such thought patterns support more effective instruction?"

My interest in this research grows from the way in which it is daily brought home to me as a teacher that even my best, most efficient lessons are frequently rendered moot by what seems to be the determining effect of students' self-talk. An anecdote

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may serve to illustrate. I once spent a full hour of math instruction time carefully laying out a somewhat complex procedure which students were to utilize for that night's homework. I was able to take my time and ensure that everyone in the room clearly understood the procedure. We did board notes, student notes, oral recitation, question and answer, guided practice, independent practice, until it was quite clear to me and the students that for all practical purposes everyone understood things well. The next morning, we corrected and graded the related homework assignment, and the majority of student grades turned out to be in the C, D and F range. When I asked the students (with whom I have a good communicative rapport) to raise their hand if they felt that they had carefully tried to follow the procedure we had so painstakingly laid out the day before, only two out of 24 students' hands went up. When I asked the rest of them, "What did the rest of you do?" their answer was, essentially, "We made something up."

My teaching partner, who teaches these same students reading, reports that the same pattern prevails in her classes. When she sends the students home with relatively straightforward comprehension questions (readily answerable if the students are willing to refer back to the text), the vast majority come in with answers that are incorrect, incomplete or otherwise ill-considered.

Clearly, the students' governing patterns of self-talk as they complete assignments are far from those which we as educators would wish them to be. The heuristic habit of holding one's own thought processes and work output to some absolute standard of correctness – which is the habit upon which most teaching efforts must rely, if quality independent student work is a desired outcome – seems essentially absent in these students. In my partner's case, the "authoritative standard" would be the text of the assigned story, whereas in my mathematical example it would be the students' memory and notes concerning the procedure we had done in class. In

neither case do the students display a habit of comparing their own output to some authoritative standard of correctness. They seem to prefer taking whatever rises up out of their understanding at first pass as sufficient.

It would seem obvious that the heuristic, or the structure of mental categories and labels which is governing their work, in actuality is far different from that which we teachers would like to believe. What the students are *not* doing, cognitively, is self-evident. The relevant questions would seem to be, "What are they doing? What are the cognitive patterns which are trumping those which we as teachers daily and so often unsuccessfully cheerlead them into adopting?"

I am increasingly convinced as a teacher that gaining a better understanding of students' patterns of self-talk -- their operative mental frameworks and governing cognitive structures -- is critical to the success of my teaching efforts. If crystal-clear, concrete teaching can so easily be rendered immaterial by what are apparently deeply entrenched patterns of self-talk, and in the face of which even nominally effective teaching cannot penetrate or find a meaningful place, then it seems obvious that such student self-talk must become a critical focus of my work as a teacher. A better understanding of the nature and patterns of such student self-talk would seem to be a prerequisite for any attempt either to alter those patterns so that they better support the students' prescribed academic pursuits, or to change teaching efforts so that lessons might better match the existing "windows" of student receptivity which such patterns impose.

This notion of the key and potentially determining role of student self-talk is supported by the work of C. M. Kronk (1994). Although Kronk's focus is on verbally articulated "private speech," and is thus somewhat different than my own, she cites Frauenglass and Diaz (1985) as having classified private speech into four functional

categories; *self-regulatory* [my emphasis], self-reinforcing, task irrelevant and whispers, and also cites Vygotsky as having defined private speech as self-regulatory (Kronk, 1994, p. 782). She also states that "many theorists (Berk, 1986; Berk & Garvin, 1984; Wertsch, 1979) have focused on private speech's regulatory function in cognition." (Kronk, 1994, p. 783) This would support my notion of the potentially determinant nature of self-talk and thus its appropriateness as a focus of inquiry.

Kronk, of course, is focusing on verbally articulated self-talk. But this may not be disqualifying for comparative purposes, because she later notes that:

Vygotsky and the other theorists (e.g., Beudichon, 1973; Berk, 1986, 1992; Berk & Garvin, 1984; Bivens & Berk, 1990; Kohlberg et al., 1968) who followed him, have speculated that private speech disappears because it develops into internal thought. (Kronk, 1994, p. 783)

If this is true, then the distinction between verbally articulated "private speech" and internal thought may be a small one.

Kronk cites further research which supports the determining effect of self-talk, although here again, in a verbalized form:

Several studies (Flavell, Beach, & Chinsky, 1966; Girodo & Roehl, 1978; Kenney, Cannizzo, & Flavell, 1967; Payane & Manning, 1990; Rosin & Nelson, 1983) have focused on the use of private speech training in adults to improve performance on various tasks. (Kronk, 1994, p. 787)

Meichenbaum (1977)... found that having his clients talk about what they were doing while working on a task increased performance. (Kronk, 1994, p. 787)

Children have also been trained successfully to use self-talk with tasks (Johnston, Johnson & Gray, 1987; Meacham, 1979). Children who have had difficulty concentrating on assignments have done especially well when trained to use self-talk. (Kronk, 1994, p. 788)

Finally, Kronk's citation of John-Steiner's 1992 finding that "essentially, private speech evolves into private writing" may perhaps reduce or eliminate the importance of

the distinction between her focus on verbalized self-talk and my own focus on thoughts captured through writing. (Kronk, 1994, p. 790)

Kamann & Wong (1993) also support my notion of the malleable and potentially determining nature of self-talk:

Learning an appropriate coping strategy effectively changed the patterns in self-dialogue of children with LD. Prior to intervention, compared to normally achieving children, these children with LD produced a significantly larger proportion of negative self-statements in their self-talk. Subsequent to the intervention, the positive self-statements in their self-talk increased substantially. (Kamann & Wong, 1993, p. 636)

General support for the importance of self-talk (or "inner speech," as he calls it) appears in Smolucha (1993), as follows:

While the observation of inner speech remains a methodologically complex phenomenon which, for obvious reasons, does not lend itself easily to direct empirical observation, the existence of inner speech and its influence upon patterns of thinking have been widely acknowledged as critical features in several therapeutic modes, including the *cognitive therapy* of A. T. Beck and the *rational emotive therapy* of A. Ellis. (Smolucha, 1993, p. 4)

... dysfunctional patterns of inner speech (i.e., the "scripts" addressed in cognitive therapy) have been implicated as playing a significant role in the formation of dysfunctional patterns of behavior. Similarly, the idea of teaching clients to "rewrite" these dysfunctional scripts, by adopting more effective forms of social and private speech, has been demonstrated to ameliorate many forms of dysfunctional behavior. (Smolucha, 1993, p. 4)

Nuthall (1997) also offers support for the basic premise of the collective and social origins of much of mental processing, together with an endorsement of the importance of understanding the details of student self-talk:

There is increasing empirical and theoretical support for the view that the processes that constitute the mind are socially and culturally constructed (cf. Cobb & Yackel, 1996; Fernyhough, 1996; John-Steiner & Mahn, 1996; Nelson, 1993, 1996). Following the work of Vygotsky on the social origins of the higher mental processes, there are an increasing number of studies of

the way social structures and processes are 'internalised' as mental structures and processes (cf. Miller, 1987; Perret-Clermont, Perret, & Bell, 1991; Feigenbaum, 1992). The classroom is the place where students are required to participate continuously in activities that are structured to organise and facilitate the acquisition of knowledge. It follows that the classroom is likely to be one of the major sites in which students acquire and develop those cognitive processes that are the basis of knowledge acquisition. If this is the case, then it is important to identify and understand how this occurs. Different ways of structuring and managing classroom activities will have different effects on both the type and quality of the cognitive processes that students acquire. To put it more simply, we need to understand how classroom experience shapes those processes that constitute students' minds. Without such understanding, attempts to 'reform' teaching and the management of students' classroom experiences may focus on the irrelevant and the trivial and leave untouched those aspects that have the most profound and long-term effects on students' intellectual development. (Nuthall, 1997, p. 4)

In short, there is considerable support in existing research for the notion that self-talk both plays an important and perhaps determining role in task performance, and for the basic assumption that it is a variable and adaptable entity which is at least potentially amenable to classroom-based efforts to optimize it, with a view to improving academic results.

RESEARCH DESIGN

Why Qualitative?

This research effort is qualitative in nature (as distinct from quantitative). Whereas the traditional, quantitative experimental model formulates a hypothesis prior to the design and execution of the research itself, the qualitative model turns *first* to the research. Only *after* gathering the data does the qualitative researcher begin to consider explicative hypotheses. As Maykut & Morehouse (1994) observe, "...what is important to analyze emerges from the data itself, out of a process of inductive reasoning."

A further distinction of such research is that the qualitative researcher is generally free to alter the design of his or her research as it evolves, unbound by the strictures of a pre-existing governing hypothesis which would prevent a quantitative researcher from so doing. Research which takes advantage of this aspect of the qualitative paradigm is known as *emergent-design* research.

The roots of the qualitative research paradigm lie in sociological and ethnographic research, in which the researcher gathers data on the subject culture as encyclopedically and unobtrusively as possible, in order to gain a better *understanding* of the particular details of the people under study. One might spend a year among the peoples of the Trobriand Islands or with the Yanomamo of Brazil, observing, interviewing, taking field notes, and seeking to grasp the patterns and principles which govern their words, thoughts and behavior. In the course of such study, it would of course be a natural part of the discovery and analysis process to generate explicative hypotheses. But, it is significant that in the qualitative paradigm this is a secondary rather than a primary process.

Perhaps the most important distinctive feature of the qualitative paradigm is that it does not claim the mantle of "objectivity" for itself as does the traditional quantitative paradigm, choosing instead to embrace and make a virtue out of its very subjectivity. Whereas quantitative research data is gathered through the use of nominally "objective" non-human instruments wherever possible, in qualitative work the researcher relies on the notion of "human-as-instrument," as follows:

A person, that is, a human-as-instrument, is the only instrument which is flexible enough to capture the complexity, subtlety, and constantly changing situation which is the human experience. And it is human experiences and situations that are the subjects of qualitative research. Human-as-instrument simply means that it is the person with all of her or his skills, experience, background, and knowledge as well as biases

which is the primary, if not the exclusive, source of all data collection and analysis. (Maykut & Morehouse, 1994, p. 26)

Although qualitative research makes every effort to identify (inasmuch as possible) subjective biases which might affect the process of data capture and analysis, it is unique in that rather than abhorring such bias, qualitative research accepts it as a necessary and perhaps even complementary aspect of the process of seeking to understand the systems and structures underlying complex human behavior.

As such, the qualitative paradigm is ideally suited to the focus of this research. There is perhaps no more complex, ephemeral and essentially "human" activity than thought itself, and it is just such thought which is my research focus. Were I to attempt to utilize the quantitative model in pursuit of greater "objectivity," I would run immediately into the obstacle of data-capture, since in order for a thought to be transmitted to the researcher it must be selected and articulated by the research subject, with all the obvious possibilities for editorializing, people-pleasing and pre-selection which such a process presents. Thus, in addition to the notoriously subjective nature of thought itself, these data-capture problems would more or less defeat any genuine claim to "objectivity" from the outset. The qualitative model, designed as it is to embrace and include subjectivity rather than try to eliminate it, therefore seems the natural choice.

This research was initially conceived as an emergent-design effort, at the urging of the professor teaching the final, summative research project course for which this project was undertaken. However, the practical constraints of carrying out the research, data analysis and publication process during the course of one semester while simultaneously teaching full-time eventually dictated a reversion to non-emergent design, in which I limited myself to my initial research scheme, rather than pursuing possible alternate data-capture avenues which suggested themselves in the course of

the research. Such additional efforts might form part of a further project at a later date, however.

The Design Itself

This research project was envisioned as a relatively simple, short-duration effort designed to indicate areas for further study based on provisional hypotheses which the data might suggest.

My research participants were to consist of one of my sixth-grade classes [the same mathematics class with whom I had the eye-opening teaching/learning experience described in the introductory remarks]. I sought to capture (to as large a degree as possible) the students' thoughts, feelings and judgments as they sat in my math class, whether that might be while listening to me present new material, while taking a quiz or test, or while working independently. I recognized that data-capture would be limited, due to the students' difficulty writing down extensive thoughts in journals while simultaneously attending to a math lesson presented under the pressure of an "always-too-short" class period.

My goal was simple (as I wrote in my research journal early on):

Could I try to get hold of the labels, the self-talk "bins" into which the children are tossing my educational efforts, generally, and look for links between the labels and the educational results? ...What I should do is try to get a handle on the internal self-talk operating behind the facade of observable student behavior.

In pursuit of this, I planned to distribute individual "Math Journals" to each student in class, telling them that I was interested in learning more about their thoughts and feelings as we worked together and then analyze the resulting entries. I originally considered conducting group interviews as well, to provide a second means of data capture, but the time required for the data analysis of just the journal comments proved so substantial that this additional effort would have exceeded time limits of this project.

As for data analysis, I planned to rely upon the constant comparative method as outlined by Maykut & Morehouse (1994) (which served as the basal text for the course).

Provisions for Trustworthiness

In an effort to maximize the trustworthiness (and therefore the potential impact) of this research, I sought to rely first upon publishing as detailed and open a research report as possible, giving full details about the design, execution and analysis of the project, including appendices consisting of my research journal and data transcripts so that I would leave a clear and concise audit trail. I also felt that the (relatively) substantial size of my participant population of 23 students would tend to strengthen the validity of my results.

I recognized, however, that perhaps the two greatest factors delimiting the trustworthiness of the research were the non-random, single class sample and the reliance upon a single method of data capture. Although I knew that the trustworthiness of the study would be substantially increased were I to include a second means of data-capture (above and beyond the use of the journals), I had to jettison this due to the aforementioned time constraints. Similarly, my desire to expand the study to include a different group of students studying a different subject (perhaps even with a different instructor) proved to be beyond the practical limits within which I was working.

One positive aspect with regard to trustworthiness, however, will be my readiness to incorporate (and thus further explore and test) my own results into my work as a teacher. The very genesis of the project sprang from my daily teaching work, and its results will likewise be incorporated fully into my daily teaching efforts.

METHODS

Sample, Access and Data Collection

The sample for this research project consisted of one sixth-grade math class of 23 students (seventeen girls and six boys), in the suburban town of Hamilton Park, NJ [pseudonym]. Hamilton Park is a middle-class, predominantly white town in Bergen County, within a half-hour or so of New York City. The school building where the research was sited is one of two K-6 elementary schools feeding the town's own 7-12 junior-senior high school. Hamilton Park is something of a local anomaly in that it runs its own high school instead of feeding its students into a larger regionalized school. This is a point of local pride and contributes to the fairly substantial sense of community which predominates in the town.

None of the students in this study had incomes low enough to cause them to apply for free milk at lunch. In terms of percentages of students passing the New Jersey High School Proficiency Test [a state-wide test of minimum academic competencies necessary to graduate], Hamilton Park was recently ranked best in the county and among the best in the state for its district size group.

The students were part of a two-homeroom sixth grade, taught non-departmentally – that is to say, in the "old-fashioned," self-contained manner, as distinct from the more modern tendency to departmentalize teachers into academic specialties even in upper elementary school. All of their non-specialized subjects were taught by one male and one female teacher. Students were grouped homogeneously by ability for reading and mathematics, and heterogeneously for all other subjects.

The 1963 school building is of a modern, one-story design, set on a wooded hilltop surrounded on all sides by private homes. Students bring their own lunches to school and are either dropped off at school by their parents or walk themselves (there is no bus service).

The student participants in this study were members of the "lower" of the two homogeneously-grouped math classes, consisting of seventeen girls and six boys, aged 11-12. Such a number of subjects would be considered small by traditional quantitative standards, because the particular requirements of the mathematical and statistical tools relied upon in quantitative data analysis require larger numbers (Maykut & Morehouse, 1994, p. 56). Freed from this requirement, the qualitative model can manage with far fewer subjects – Maykut & Morehouse mention minimums of twelve and comfortable cut-off points of 25 at which "data saturation" can occur (Maykut & Morehouse, 1994, p. 63). In this light, my count of 23 seems reasonable, particularly given the authors' acknowledgment that:

Practically speaking, the sampling concepts of saturation of information and diminishing returns may have to be balanced with limitations of time, money, and other factors that impinge upon the research enterprise. (Maykut & Morehouse, 1994, p. 63)

As for the selection of the actual participants themselves, I should here acknowledge that, whereas standard qualitative research recommendations call for maximum variation sampling to approximate randomness at least to some degree, my participant selection was governed principally by considerations of practicality and access. I knew that the logistical and interpersonal barriers involved in accessing other teachers' classrooms meant that I would be restricted to the use of my own students. In addition, I knew I wanted my "research" to take as low a profile as possible, and the best way to achieve this was to have an entire class all doing the same thing – namely, jotting thoughts in math journals. Supporting students in developing their meta-

cognitive ability by having them observe and record aspects of their own thinking and learning processes in a journal is a standard and well-accepted educational approach. Students in my building have been asked to "keep journals" in class for years, on and off, and it has been a normal practice for teachers to periodically read their contents. As a result, I knew that having the whole class pursue an incidental and optional activity with journals could be easily justified in pedagogical terms, quite apart from my own extra-curricular purposes for the research.

Had I sought to carefully select a sub-group to achieve maximum variation sampling, I would have had to abandon such a low-profile approach. Students might have felt concern about "Why didn't he pick me?" Given the intense pressure to cover material under which we operate daily, the only legitimate basis for my taking even a few minutes of daily class time for the students to jot thoughts in their journals was that it was beneficial for the students' learning. This certainly was the case, and I knew I would have no difficulty defending such a position if challenged. However, the very educational utility of the journals rendered unanswerable the query "Why would you give some students that benefit and not others?" I could not have surveyed or selected out students for maximum variation sampling without potentially raising concerns about elevating my own concerns above the students' educational needs, and I was concerned *not* to do this, because I feared that doing so might be perceived by some as a lack of commitment to the students' maximum achievement, or might even proffer myself as a potential target for students, parents or administrators looking for someone on whom to blame a real or imagined shortfall in academic achievement.

The elegance of the "math journal" solution lay in the fact that it allowed me to achieve the necessary data-capture for the research by means of an accepted educational activity which fully supported the students' regular curricular academic achievement. Other approaches which might have achieved more in the way of maximum sample variation would have brought with them the downside (in terms of either reality or appearances) of "taking time away from teaching the kids," and this I could not do, in good conscience.

Finally, if any further rationalization for my sampling approach were called for, I would suggest that it might lie in thinking of this research as the initial phase of an ongoing project which could then subsequently involve *snowball sampling* designed to maximize sample variation as the research unfolded, as suggested in Maykut & Morehouse (1994). Ideally, such snowball sampling would be a part of this current research; but, the simple truth of the matter is that doing so would have expanded the scope of the project to such a degree that it would have created access problems, not to mention difficulties completing the project within the time frame of the one-semester course for which this study was undertaken.

The "cast of characters" comprising the participants in this study is a varied group which also shares some common characteristics. Perhaps the most notable shared characteristic is a relative lack of personal commitment to the quality of their mathematics schoolwork. This is a broad and subjectively drawn statement, but it reflects the homogeneously grouped nature of the class. My students were the "lower" of two groups, and the more highly motivated students were, quite simply, in my partner's class, not mine. This characteristic expressed itself regularly in a general vagueness of focus and reluctance to engage with the subject material. Student attention needed to be monitored closely by the teacher, homework quality needed to

be checked daily, and frequent motivational pep talks were called for. To borrow a bit of current argot, their attitude toward math could generally be summed up by the expression, "Whatever." There was very little in the way of intrinsic rewards evident for these students in their work.

Individually, of course, there was considerable variation amongst them. Some of their more noteworthy distinctions included the following:

Amethyst: Beautiful and socially successful, Amethyst could probably have made it in the "higher" math class, had she been willing to discipline herself to do the work. As it was, she usually understood things fairly well, although she made it clear that academics were not her top priority.

Amy: High spirited, cheerful and usually well-focused, Amy would usually master concepts by the end of the day.

Bonnie: Hard-working and diligent, Bonnie could execute the mechanics of math procedures efficiently, but had very weak math sense. For example, she could not recognize the difference between real-world situations calling for division as distinct from those calling for multiplication.

Carley: Perhaps my biggest motivational problem, Carley rarely paid attention in class. She was quite able to do the work when she opted to focus on it, but she almost never chose to do so.

Charles: Charles was a social leader, and quite intelligent. He seemed to have developed such a habit of letting his mental faculties "drift," however, that he had difficulty attending, and would alternate between success and failure in class.

Cindy: Cindy was an able math student, and might have been able to manage the "higher" math class. One of my top performers, she tended to remain in the background of the class.

Danielle: Able to do the work when a teacher required her to focus in and concentrate, Danielle had great difficulty doing so by herself in class, so her attention was very often completely off-focus. Other times, she would make valuable contributions and demonstrate good understanding. Tests would often get the best of her, however.

Elise: Quiet, petite and thoughtful, Elise alternated between success and failure in the class. Her motivation was generally good, but she would rarely seek help, and would often settle for a very shaky understanding of principles.

Glenda: One of my most able students in terms of innate ability, yet only intermittently motivated to do careful work.

Katrina: Well able to work and frequently motivated to do so, Katrina was a top performer. Her work in other classes, however, expressed considerable lack of commitment to schoolwork.

Louis: Extremely reluctant to work, Louis required hypervigilant supervision from his parents and teachers in order for him to produce anything resembling grade-level work. In the resource room for other subjects, he tended to pull C's and B's in math class.

Louise: Perhaps my most "businesslike" member of the class, Louise was also a relatively gifted math student and one of the top performers. Logic and problem solving remained difficult for her, however.

Linda: Math came easily to her, which was fortunate, because she had great difficulty attending to work which did not come easily.

Michael: New to the district, Michael was heavily occupied with trying to integrate himself socially into a group of students that had all known each other since kindergarten. This task occupied most of his energies, and when he discerned that lower academic achievement might actually gain him greater entree into the "cooler" group of students, he began to let his work go.

Paul: Paul was something of a "Huckleberry Finn" character. In the resource room for other subjects, he was well able to do the math work in my regular classroom but would sigh wistfully when forced to do so, as if the work were sadly burdensome to him.

Polly: With lots of structure and support to help her focus, she could do fine, although long term retention of content was a problem. Essentially, she needed regular extra help from the teacher to help her clarify concepts but was reluctant to seek it out. She was subsequently placed in the resource room for mathematics instruction.

Sam: Sam was a conundrum. He was highly gifted in terms of his scores on IQ tests but was substantially unwilling to do the kind of daily "scutwork" required in school. His preference was to "blow off" daily homework (bringing in a string of assignments that would earn 50's and 60's when graded) and then demonstrate his innate abilities by earning 85's or 90's on tests.

Shari: Sweet and studious, Shari would do careful homework but would often run into difficulty on quizzes and tests. Generally, she needed support to help her focus in on the correct procedure.

Stephen: Stephen vastly preferred cheerful idleness to productive engagement with work. When forced by external influences to get down to it, he could do just fine; but, he had almost no innate desire or willingness to do so.

Susan: Very quiet and very sweet, Susan could do well and often did. She would sometimes get lost in a foggy netherworld which kept her from understanding our work, however, particularly earlier on in the year.

Tammy: Another sweet and hard-working student, Tammy would try hard and often ask for help understanding concepts which eluded her, but it was an uphill struggle. Long-term retention was very difficult for her and mathematical logic and problem solving seemed almost beyond her grasp.

Wanda: Wanda was quite intelligent and well able to express herself. Her work habits were quite sloppy, however, it was clear that she was ill-accustomed to editing or checking her work to see whether it reflected the quality of her innate abilities, and so most often it did not.

Yvonne: Perhaps the hardest working student in the class, Yvonne had fought her way back into the regular classroom from the resource room by dint of hard work at home with her mother and a tutor. She was something of a "teacher's dream" because she would seek out help whenever she was having difficulty with a concept, and she made the work personally important to her.

Together, we maintained a class atmosphere that was generally cheerful and relaxed but with an undercurrent of urgency derived from the need to cover and master (at least temporarily) our required course of study. Jokes were frequent, as were teacher reminders that we had to "get down to business." Perhaps a good description of the class climate would be "fun but strict" (the precise words used in several of the students' journals, in fact!)

The actual data collection instruments (the math "journals") were created by fastening 4-5 sheets of lined white composition paper together in the upper left-hand corner with a paper fastener. Each student had his or her name hand-written by me on

the front "cover page." I handed these out to the class at the start of a class period, and told the students that these were their "math journals." My explanation was more or less as follows:

I would like to learn more about your thoughts and feelings as we do our math work together because I'm interested in connections between how you work and what you think. What's more, it can help you to begin keeping track of your own thought process as we work together.

So, what I'd like you to do is simply jot down whatever might be going through your mind. If you are enjoying something, write down what you think. If you think something is stupid and you hate it, write that down, too. If you think I am doing a good job, write that down. If you think I'm being the worst math teacher in the world, write that down too. I just want to get a peek into what you are thinking as we work together.

I will be reading your entries and typing them out so that I can keep track of them. You may say whatever you like – anything at all. I will never comment to you about anything that you write, so nothing that you write will ever become part of a discussion between you and me. No one else in school will read these journals, so you can feel free to express any thought or any opinion. It will have absolutely nothing to do with your grade or my opinion of you.

I will hand them out at the start of each period, and collect them at the end of each period. Begin by simply writing down the date, and then whatever crosses your mind as you work. Please go ahead and take a minute to jot anything down now that you might like to enter.

Each day, I would transcribe their comments with a word processor, creating a master document with separate sections for each student's dated entries. As I transcribed each manuscript journal entry, I would mark a check in red pen next to that entry in the journal to identify it as having been read and transcribed.

As data collection proceeded, several things quickly became apparent. One was that the crush of business during each class period sometimes caused me to forget to distribute the journals to the students. In a similar vein, I once or twice dismissed the students before I had systematically collected the journals and so had to chase after them later. Furthermore, there were great variations in the degree to which

students opted to make entries in their journals. Carley displayed almost no interest in attending to normal math activities in class but dove into her journal with great gusto, writing long, heartfelt entries. Other students such as Louis, Stephen, and Charles wrote barely more than a few terse words.

Another interesting development was that data-collection was definitely affected by something of a "honeymoon effect." Early on, when the journals were a novelty, students' entries were longer and the percentage of students making entries on a given day was quite high. As the data collection process proceeded, however, entries grew noticeably shorter and fewer in number.

One final note was that students were quite alert to whether or not I had been reading their journals. At one point, circumstances caused me to fall a few days behind in my transcription efforts so that the students were being handed journals in which the previous days' entries had not been marked as "read and transcribed." The students made no comment in response to this until I later caught up, but when I next handed out the transcribed journals, comments along the lines of, "Good, now you've read it" were heard.

Perhaps the final aspect of the data collection process which requires inclusion here is a close description of the particulars of my own "human-as-instrument" self. Since all of the data collection was conceived, monitored and mediated through that self, these particulars can only have had a substantial influence upon numerous aspects of the research, ranging from its initial design to data analysis and final interpretation.

I am a 44-year-old Irish/German/English-American male possessing a Baccalaureate Degree in Literature and (at the time this research was conducted) a nearly complete masters degree in Education (M. Ed.) with a concentration in Critical

Thinking. I entered teaching through New Jersey's "alternate route" to teacher certification some seven years ago and have been teaching sixth grade full-time since then, with one year of leave for the birth of my daughter (now almost three).

As a teacher, I tend to be somewhat demanding of my students. My reputation among the parents is "excellent social studies and writing teacher," and (generally) "hard but good." I frequently hear myself telling my colleagues, "The older I get, the more old-fashioned my teaching becomes." By this I mean to refer to the fact that I find many currently fashionable elements of progressive educational practice to lack effectiveness unless they are (at a minimum) accompanied with such out-of-favor methods as drill, memorization, recitation, etc.

My teaching style tends to alternate between relaxed/humorous/unstructured and strict/structured/demanding. My goal for the classroom (which reflects my personal as well as my professional priorities) is to establish and participate fully in an experience of community with the students. This causes me to put aside authority structures in favor of shared laughter and relaxation whenever possible, only to find that I then must reassert them in order to "get the job done." This may at times make for a somewhat "schiz-y" experience for some of the students, who naturally respond to the unstructured informality with a tendency to "top" each other's jokes and test the limits only to suddenly find me "tightening up." If this leaves some of my students with the puzzling question, "Wait, I can't decide if he's funny and nice, or mean!" I can understand why. My hope is that as my career continues to develop, I will learn more of the secrets of maintaining a constant ideal balance as an educator.

As for the school in which I work, I should acknowledge that since my very first teaching job was this post in this school, I lack the points of reference from other districts or even other buildings which a more broadly experienced teacher would have.

That caveat aside, however, I would observe that the four principals under which I have worked in my seven-year tenure have all tended to make comments about how "wonderful" the staff in our building is. There is little to no backbiting or competition of any consequence; teachers simply go about the business of educating the children in good spirits and with a sense of shared mission and duty, however varied our teaching approaches might be.

The building is certainly educationally conservative; traditional textbook-based approaches tend to govern heavily, and there is little in the way of cutting edge progressivism going on. Similarly, each teacher tends to "do his or her own thing." Cross-grade activities certainly take place, but they are more the exception than the rule.

The district places great stock in standardized test scores, so most of our educational efforts are ultimately measured by that yardstick. I myself tend to agree with this emphasis; I find the currently fashionable attacks on the validity of such tests unpersuasive. I analyze my own test scores exhaustively every spring with a computer spreadsheet, looking to see whether I have been able to support my students in achieving a higher percentage of their academic potential during their year with me (relative to their previous, fifth grade year) or not. I regard test score gains as an indication that what I am doing is "working," and test score erosion as an indication of the reverse, precisely as if I were a salesman and the test scores were my sales figures.

As for my own "niche" within the staff, it is perhaps strangely dualistic. On the one hand, my college degree (from an Ivy League university), my (relatively) complex habits of linguistic expression, and my status as one of only three males in the building (and the only male regular-subject instructor) may tend to elevate my extrinsic authority

and position in some ways. On the other hand, my love of community-spiritedness and humor cause me to spend considerable energies "leaping off" of any extrinsically sourced pedestal which anyone might have temporarily elevated me to. I am the "teller of jokes" in the building, as well as the "giver of compliments" – I constantly compliment the female staffmembers' appearances. This at least partly parallels my role with the students as well; I am known for telling corny jokes and doing silly voices and theatrical improvisations in the course of my teaching day. This pattern should probably be understood as an effort on my part to construct an identity based on intrinsic selfhood. I tend to flee any effort to recognize me for some extrinsic, externally-based characteristic (and have done so for much of my life).

As for the "questions" which animate me in my career as a teacher, the most important of them is probably, "Can I construct an environment, a community, a teaching method, which will equip students with an effective mastery of the skills we are required to cover and also develop their individual, group, personal and spiritual resources and identities?"

I have achieved some success at this. I have been twice nominated by former students as a member of "Who's Who Among America's Teachers," and am generally considered a hard-working and effective teacher by the parent community. A former student who plans to become a teacher herself recently told me that I am the reason for her career choice; she hopes that she will be able to affect her students in the way that I affected her. One of my current class parents recently asked whether I would consider teaching seventh grade to her son next year, because my "genuine love of the kids will be a tough act to follow." *[I include these testimonials out of a concern that the frank assessments of some of my own thought processes included later in the Outcomes section of this report may cause some readers to (incorrectly, in my view)*

label me as an uncaring or overly self-involved teacher.] As I make my way through my daily routine with the students, I am continually nagged, however, by a deep sense that a substantial portion of my teaching efforts could be much more effective if only....? This is the professional mystery which animates me, and in pursuit of which this research was, in part, undertaken.

Data Analysis

Data analysis was based on the constant comparative method, succinctly described in part by Maykut & Morehouse (citing Lincoln and Guba, 1985) as follows:

The essential tasks of categorizing are to bring together into provisional categories those cards [data cards] that apparently relate to the same content; to devise rules that describe category properties and that can, ultimately, be used to justify the inclusion of each card that remains to be assigned to the category as well as to provide a basis for later tests of replicability; and to render the category internally consistent. (Maykut & Morehouse, 1994, p. 134)

Following this method, my first task was to read over the typed transcripts of the students' journal entries looking for "units of meaning." Here again, Maykut & Morehouse (1994) rely on Lincoln & Guba (1985):

The process of qualitative data analysis is one of culling for meaning from the words and actions of the participants in the study, framed by the researcher's focus of inquiry. This search for meaning is accomplished by first identifying the smaller units of meaning in the data, which will later serve as the basis for defining larger categories of meaning. (Maykut & Morehouse, 1994, p. 128)

Each time I identified what seemed to be a unit of meaning in a student's journal entry, I cut it out of the transcript page, mounted it on a 5x7 index card, coded the card with a notation of the student's name and date of entry, and then jotted down on the card a few words or phrases which seemed to express the essence of the apparent meaning.

This process yielded a total of 140 data cards, which I began to place in piles on a table as repetitive patterns or themes seemed to present themselves.

The next phase of my data analysis process was to go through each card again, one by one, considering its apparent meaning and reassessing the preliminary categories into which I had initially sorted them. In addition, I reread my research journal [see Appendix], looking to further identify what were the recurring words, phrases and ideas present in the data. This resulted in my resorting some cards into different piles as various new aspects of the data began to seem more important than some others which had previously struck a chord with me. I ended this process with a total of sixteen preliminary piles; each of which seemed to represent some sort of pattern or current within the data.

At this point, I reviewed each card yet again, and came up with a preliminary phrase to try and describe the meaning seemingly present in each pile of data cards. I transferred these onto a large sheet of brown kraft paper which I had spread out on a table in front of me, and created a brainstorming/web map of what I had come up with so far, with the following results:

How is the leader doing? [26 cards]

Flight/Distress/Humiliation/I have no place here. [14 cards]

It's hard (general). [3 cards]

It's hard (specific content). [7 cards]

Requests for help. [4 cards]

It's easy (general). [25 cards]

It's easy (specific content). [15 cards]

Pleasure. [7 cards]

Hope. [2 cards]

Self-Coaching (specific). [2 cards]

How successful do I think I am? [14 cards]

How is my mind working? [3 cards]

What did I get? [8 cards]

Self-analysis. [6 cards]

Content-related excursion [2 cards]

Miscellaneous. [2 cards]

One of the first things which became apparent as I continued to review the unitized data was the striking paucity of journal entries which had anything to do with the content of the course per se, for its own sake. Out of 140 cards, only two [the "Content-Related Excursion" cards] actually related to math content for its own sake, and that is only slightly more than one percent of the total. All other specific references to course content were made only as part of a larger focus on whether or not the work seemed difficult, etc. That means that in almost 99 percent of the students' mental activity (at least as identified by my admittedly crude data-capture device), the content of the subject matter played only an incidental role or no direct role at all.

This was a striking observation to say the least, and one which supported some of the concerns which I had held prior to beginning the research – namely, that whatever was governing the students' cognitive processes, it certainly had little to do with the discipline of mathematics as I was trying to teach it. This naturally gave rise to the question, "Okay, then what sort of pattern or structure *is* governing their thoughts? Not long into this process of inquiry, conducted as I looked over my kraft-paper web of preliminary data categories, an answer presented itself to me in something of a moment of discovery. Almost all of my preliminary "pile" categories fit very well into a

set of three basic, overarching considerations or questions which sprang to mind from a sort of socio-biological point of view, as follows (phrased from the students' point of view):

- A) What kind of threat/difficulty/danger am I facing right now?
- B) What is my position within the larger student social group ("How am I doing?")
- C) What kind of job is the group leader doing for me/for us?

When I rearranged the initial "pile" categories within this new framework, the results were as follows:

A) What kind of threat/difficulty/danger am I facing right now?

- 1) *It's hard (general)*. [3 cards]
- 2) *It's hard (specific content)*. [7 cards]
- 3) *Requests for help*. [4 cards]
- 4) *It's easy (general)*. [25 cards]
- 5) *It's easy (specific content)*. [15 cards]
- 6) *Pleasure*. [7 cards]

TOTAL CARD COUNT: 61/140 = 44%

B) What is my position within the larger group ("How'm I doing?")

- 1) *Hope*. [2 cards]
- 2) *Self-Coaching (specific)*. [2 cards]
- 3) *How successful do I think I am?* [14 cards]
- 4) *How is my mind working?* [3 cards]
- 5) *What did I get?* [8 cards]
- 6) *Self-analysis*. [6 cards]

7) Flight/Distress/Humiliation/I have no place here. [14 cards]

TOTAL CARD COUNT: 49/140 = 35%

C) What kind of job is the group leader doing for me/for us?

1) How is the leader doing? [26 cards]

TOTAL CARD COUNT: 26/140 = 19%

PERCENT OF CARDS ACCOUNTED FOR SO FAR: 98%

D) Other: [remaining cards unaccounted for by above framework]

1) Content-related excursion [2 cards]

2) Miscellaneous [2 cards]

TOTAL CARD COUNT: 4/140 = 3%

[AGGREGATE PERCENTAGE 101% DUE TO ROUNDING]

At this point, I proceeded with the next phase of constant comparative analysis, which was generating **rules for inclusion** based on the cards in each main provisional category. The first main provisional category to which I turned was A: *Threat/Difficulty/Danger Assessment*. It was not yet clear whether any of the provisional subcategories into which I had first grouped the cards (*Hard, Easy, Flight/Distress, etc.*) would remain important.

On closer inspection, the subcategory *Requests for Help* [four cards] seemed better suited to main provisional category B: *What is my position within the larger group* ("How'm I doing?"). With this done, all cards remaining in this first main provisional category seemed to fit well together, leading me to search for a rule for inclusion. Set out below are the five remaining working subcategories into which the cards in this main provisional category were grouped, together with representative sample journal entries for each. In descending order of the number of data cards per subcategory, these are:

A) Threat Assessment [57/140 = 41%]

1) It's easy (general). [25/57 = 44%]

"This test will probably be easy."

"This test is really easy."

"Wow! Easy!"

"Easy homework. Nice test grading! Easy quiz!"

2) It's easy (specific content). [15/57 = 26%]

"Dividing mixed numbers is easy."

Dividing with mixed numbers is not difficult."

"EZ (easy) I like fractions."

"I like doing multiplying and dividing fractions it is so easy!"

"The homework for over the weekend was really easy! I like multiplying fractions better than adding or subtracting."

3) Pleasure. [7/57 = 12%]

"I love the division of Fractions. It's sooo easy!"

"Dividing fractions is fun."

"I love multiplying fractions."

"This is fun. I like simplest form!"

4) It's hard (specific content). [7/57 = 12%]

"But the word problems were not easy!"

"I hate putting fractions from least to greatest!!! It takes too much time!!"

"Hate putting fractions in order!"

"AHHH! Multiplacation and division always haunt me. I know how to do it but still, I will start with number 1."

"This division is getting to me. I HATE DIVISION!"

5) It's hard (general). [3/57 = 5%]

"Now I am getting to the hard part."

"But some is not so easy."

"A little hard."

Stated as a proposition, the rule for inclusion for this first provisional category (the name for which I revised to "Assess Threat") seemed to be: **Students form opinions about subject matter based primarily upon whether it appears 'hard' or 'easy,' to the exclusion of other criteria.**

Upon further review of the data in the second main provisional category "*What is my position within the larger group ('How'm I doing?')*", it quickly became apparent that the two cards I had put in the subcategory *Self-Coaching (Specific)* really belonged in the subcategory *Self-Analysis*, so I transferred them accordingly. Furthermore, the subcategory *Self-Analysis* seemed not really to belong in the main provisional category at all; its connection with higher-order thinking made it seem better related to provisional category *D: Other*. With that done, the cards in the remaining subcategories seemed to hang together well, calling for the formulation of a rule for inclusion for this main provisional category. Set out below are the six remaining working subcategories into which the cards in this main provisional category were grouped, together with representative sample journal entries for each. In descending order of the number of data cards per subcategory, these are:

B) What is my position within the larger group ("How'm I doing?") [45/140=32%]

1) Flight/Distress/Humiliation/I have no place here. [14/45 = 31%]

"I was humiliated today."

"aaahhhhh! Okay you could do this. Sigh..... I have a headache...oops"

"Math stinks!!! No just kidding. It's pretty cool."

"I'm halfway and really bored. And my hand is tired. I'm at order of operations and I could just fall asleep."

"zzzzzzzzzz"

"yay it's math again [sarcastic]"

2) How successful do I think I am? [14/45 = 31%]

"I am going to do my best! Even though some may be hard! I think I will do OK!"

"I finished the test & did my best."

"I think I will do good. It's coming to me easy."

"So far so good."

"I think I'll get a good grade."

3) What did I get? [8/45 = 18%]

"We corrected our homework all together I got 3 out of 37."

"I did okay on the math quiz, I got 1 wrong."

"I did really well. 2 wrong."

"I only got 1 wrong on the homework. That was so easy!"

"I got a 100!!! On the quiz"

4) Requests for help. [4/45 = 9%]

"I need a little help but Im still good."

"I need help with ordering fractions/I will try hard."

"I felt like I had to skip from 15 to 31 because I felt I need more practice."

"How do we divide fractions? Can you please reveiw on Monday? How do you do this: $1 \times \frac{3}{4}$? And this: $\frac{3}{4}$ div. By $\frac{2}{3}$. And 1.8 [div into] 0.3654, that I guesse is all I have to say today."

5) How is my mind working? [3/45 = 7%]

"I understand everything."

"I understand a lot of the work we do."

"It's really clear."

6) Hope. [2/45 = 4%]

"I hope this goes fast."

"Soon the CAT's are going to come. I hope I also do well on that."

Stated as a proposition, the rule for inclusion for this second provisional category (the name for which I revised to "Assess Status") seemed to be: **Students are also quite concerned with their own status and performance within their peer group.**

Upon review of the data in the third main provisional category, "What kind of job is the group leader doing for me/for us?" it all seemed to hang together well. Some samples of the included data are as follows:

C: What kind of job is the group leader doing for me/for us? [26/140 = 19%]

"Class is slowing down but I like it."

"Mr. Cunniff is a good teacher, but can be a little strict."

"I think this journal might be a good idea."

"I don't like the way Mr. Cuniff talks to people, like what he did to Polly today. He always does it to Danielle and Carley too. I don't like how he talks about peoples Faces. It's stupid & mean. Just because somebodys Face looks a certain way doesn't mean they're not paying attention."

"Mr. Cunniff is fun in Math, but can be strict."

"Mr. Cunniff can be a good teacher, but also borning! & a confusion. When I grow up I'm going to be a teacher, "but not like him."

"I don't think we should have to show work it is so easy."

"Can we just get it over with?!?"

"Were 6th graders here."

"Okay – now I am mad. I already checked my answers. How many times do we have to check our answers? Your teaching is too much, and making us forget."

Stated as a proposition, the rule for inclusion for this third provisional category (the name for which I revised to "Assess Leader") seemed to be: **Students make regular assessments of the job performance of their group leader.**

Upon review of the data assigned to the fourth main provisional category, "D: Other" it all seemed to hang together well. Its most substantial common thread was some component of higher-order thinking involving cause and effect analysis that was *not* devoted to the tasks involved in either *Assess Threat* or *Assess Leader*. The two subcategories it contained, together with some sample data entries (and a revised category name) are as follows:

D: Higher order/analytical thinking [10/140 = 7%]

1) Analysis [8/10 = 80%]

"I like this test because I hate it when you have to do 20 problems of the same stuff in a row. I get bored & careless this doesn't do that."

"Homework for me was bad because I didn't write down the right page. I'm very made at my self. I stink! I hate my self."

"Well, anyway, I am pretty sure that I did the homework right. I was really tired when I first started my math homework. I don't think I did my homework right"

"I'm not the best in math, but I try my hardest. Since I try I made the certified list."

"The quiz was easy, but I still got one wrong because I divided wrong."

"I only got one wrong. I did my best but made a stupid mistake."

"Because I know it and I get careless with the mistakes I make."

2) Content-related mental excursion [2/10 = 20%]

"Christine taught me the trick so you don't need any work. Also, for multiplying this - $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{7}$, I just multiply then reduce. It is easy!! Whatever, just multiply it before you cancel and stuff. Multiply and reduce. I hate math. Must let us mutiply and reduce unless you can find an easier way to teach us to cancel out. Multiply & REDUCE."

"Do you know what I just did? I went: $\frac{3}{10} \times \frac{1}{5}$... Thought I was adding & went $\frac{3}{10} \times \frac{2}{10} = \frac{6}{10}$!! You should tell that to people in class so they don't do that!!"

Stated as a proposition, the rule for inclusion for this fourth and final provisional category seemed to be: **Students engage in cause/effect analysis and higher order thinking relating to aspects of work done in class.**

Side by side, these four rules for inclusion (stated as propositions) read as follows:

- 1) **Students form opinions about subject matter based primarily upon whether it appears 'hard' or 'easy,' to the exclusion of other criteria.**
[41% of captured data support this proposition.]
- 2) **Students are concerned with their own status and performance within their peer group.** [32% of captured data support this proposition.]
- 3) **Students make regular assessments of the job performance of their group leader.** [19% of the captured data support this proposition.]
- 4) **Students engage in cause/effect analysis and higher order thinking relating to aspects of work done in class.** [7% of captured data support this proposition.]

A further review of the data cards in each category in light of these propositional statements resulted in no further repositionings of data; the categorized cards continued to support the rules for inclusion, even when stated as propositions.

Feedback to Population Studied

With a view to gaining feedback on these propositions from the students whose thoughts had given rise to them, I devised a narrative to read to the class. My plan was to read them my preliminary findings and solicit written feedback from them during a shortened 20-25 minute math period in which we would not be introducing new material

and in which we therefore would have the rare luxury of time that could be devoted to such metacognitive inquiry. The narrative paragraph read as follows:

Remember your math journals, in which I asked you to jot down your thoughts during math class, no matter what they might be about – any thoughts at all that you thought were worth jotting down? I had asked you to do this because I was interested in finding out more about the kinds of thoughts my students were occupied with as we did our math work together. Well, I am very grateful to you for all the work you did to write down your thoughts. Thank you all for your efforts.

When I sat down to read and think about what you all had written, some interesting patterns showed up. I wanted to let you know what they were, and also ask you to share your thoughts with me one more time, in writing, so I could see what your reactions were to what turned up. Here's the pattern:

40 percent (almost one-half) of the thoughts you wrote down were basically about, "This is hard," or, "This is easy." So, that's where about half of your thoughts seemed focused. *[Note on blackboard: "40% (almost 1/2) of thoughts about "Hard/Easy." Filled in a circle graph on board with a 40 percent segment labeled with the legend "Hard/Easy"]*

32 percent (almost exactly 1/3) of the thoughts you wrote down were about how you thought you were doing in the group – whether you were getting a good grade or a bad grade, whether you hated it or whether you liked it, and so forth. So, that's where another third of your thoughts seemed focused. *[Note on blackboard: 32% (1/3) of thoughts about, "How am I doing?" Filled in the circle graph on board with a 32 percent segment labeled with the legend "How am I doing?"]*

19 percent (almost exactly 1/5) of the thoughts you wrote down were your opinions about how I was doing as your teacher, or as the leader of our group – a good job, a bad job, or in-between. So, that's where another fifth of your thoughts seemed focused. *[Note on blackboard: 19% (1/5) of thoughts about, "How's the teacher/leader doing?" Filled in the circle graph on board with a 19 percent segment labeled with the legend, "How's the teacher/leader doing?"]*

7 percent (roughly 1/20) of the thoughts you wrote down analyzed reasons for mistakes or made math suggestions on better ways to do the math. So, that's where about 1/20 of your thoughts were focused. *[Note on blackboard: 7% (1/20) of thoughts about: a) reasons for mistakes b) math ideas. Filled in*

the circle graph on board with a 7 percent segment labeled with the legend, "Error analysis & math ideas." This roughly completed the graph with a total of 98 percent.]

Now I'd like you to simply write down any reactions or thoughts you have about what we found. One thing I'm interested in is whether this seems "about right" to you, or whether you think I've got it all wrong, or partly wrong. In other words, does this seem to match your own sense of the kinds of thoughts that fill your mind during math class, or not? But you can write down any reaction at all. We'll take a few minutes to do that, and then I'd like to open it up for a bit of discussion.

Students were then given approximately five to ten minutes of time in which to jot their reactions on sheets of paper with their names on them. These were collected and the students were invited to discuss what they'd written.

Although the ensuing discussion turned out to be a somewhat silly exercise in which the more extroverted members of the class took advantage of the forum in order to test limits by criticizing aspects of my attire, etc., the students' written comments provided a solid general affirmation of the research findings. Out of a total of 22 student responses [one student, Polly, had transferred out of the class before the feedback session took place], 15 of the 22 [$15/22 = 68\%$] voiced general or partial agreement with the results. Only three voiced disagreement [$3/22 = 14\%$], and most of these seemed to be based more on general oppositional principle than on a substantive difference of opinion. Four students [$4/22 = 18\%$] wrote responses which did not address the research findings at all. Consequently, of the eighteen responses which did address the research findings, 83 percent [$15/18 = 83\%$] voiced general or partial support for the research findings, versus just 17 percent [$3/18 = 17\%$] which expressed disagreement. I think it is reasonable to treat this as a general affirmation by the participants of the apparent validity of the research findings.

E. OUTCOMES

At this point in project, I reconsidered the wording of the four propositions I had previously articulated [see pg. 33] with a view to integrating and synthesizing them in pursuit of cogently articulated **outcome propositions**. Upon further consideration, I revised the four propositions so that their wording would reflect the ratio which each category represented as a portion of the total response pool, and so that they would begin to better correlate with each other and better express what seemed to be the most salient features of the data as I was interpreting it. The reworded propositions (together with representative data samples) were as follows:

1) Students' most frequent in-class thought pattern is an assessment of the level of "threat" which the subject matter represents to them, articulated primarily in terms of whether it appears "hard" or "easy." [41% of captured data supports this proposition.]

"Wow! Easy!"

"Easy homework. Nice test grading! Easy quiz!"

"I love the division of Fractions. It's sooo easy!"

"I hate putting fractions from least to greatest!!! It takes too much time!!"

"But the word problems were not easy!"

2) Students' second-most-frequent in-class thought pattern is an assessment of their own status and performance within their peer group.

[32% of captured data supports this proposition.]

"I think I'll get a good grade."

"We corrected our homework all together I got a 3 out of 37."

"I got a 100!!! on the quiz"

"I'm halfway and really bored. And my hand is tired. I am at order of operations and I could just fall asleep."

"zzzzzzz"

3) Students' third-most-frequent in-class thought pattern is an assessment of the job performance of their group leader [teacher]. [19% of the captured data support this proposition.]

*"Mr. Cunniff is a good teacher, but can be a little strict."
"Mr. Cunniff can be a good teacher, but also borning! & a confusion. When I grow up I'm going to be a teacher, "but not like him."
"I don't think we should have to show work it is so easy."
"Okay – now I am mad. I already checked my answers. How many times do we have to check our answers? Your teaching is too much, and making us forget."*

4) Students' least frequent in-class thought pattern is cause/effect analysis and higher order thinking related to aspects of work done in class. [7% of captured data support this proposition.]

*"I was really tired when I first started my math homework. I don't think I did my homework right."
"Because I know it and get careless with the mistakes I make."
"Do you know what I just did? I went: $3/10 \times 1/5$... Thought I was adding & went $3/10 \times 2/10 = 6/10$! You should tell that to people in class so they don't do that!!"*

Having done this, I again reviewed the data cards in each category to see whether the reworded propositions were still fully supported by the data as previously grouped. All data, as grouped, continued to fully support the reworded propositions.

The overarching outcome proposition which seemed compellingly indicated by the data (as subjectively grouped, labeled and interpreted by me) may already have become interstitially clear to the reader at this point, particularly with my mention of the term "socio-biological" earlier in the report. Perhaps the simplest way to approach its articulation is to state it in the same form in which it first occurred to me, which was essentially, *"If I could record the thought patterns of a socially-grouped collection of individuals of the same animal species living in the wild, I bet that they would be about*

the same as those of these students." This was the "flash" moment of *eureka* which gave overall structure and meaning to the data (as I assembled and interpreted it).

This would relate to Nuthall's (1997) observation (cited earlier) that:

There is increasing empirical and theoretical support for the view that the processes that constitute the mind are socially and culturally constructed (cf. Cobb & Yackel, 1996; Fernyhough, 1996; John-Steiner & Mahn, 1996; Nelson, 1993, 1996). Following the work of Vygotsky on the social origins of the higher mental processes, there are an increasing number of studies of the way social structures and processes are 'internalised' as mental structures and processes (cf. Miller, 1987; Perret-Clermont, Perret, & Bell, 1991; Feigenbaum, 1992).

In this case, what seemed to be suggested was the possibility that in addition to Nuthall's observation of the social and cultural linkage, there might perhaps also be some *biological*, species-related linkage.

Consider for illustrative purposes a group of zebras or impalas living on the savanna. Wouldn't the largest single grouping of their collected mental activity very likely be devoted to "threat assessment" – in other words, to determining whether any predators were about, and to selecting the level of defensive alertness at which they needed to maintain themselves?

Likewise, would not a second very large grouping of thoughts be devoted to the exploration, maintenance and realignment of the social hierarchy which governed their lives in the group? When animals are thrown together, one of the first activities they pursue is to establish where they stand in the social pecking order which will determine who gets to mate with whom, who gets to eat first, second and last, etc. I am under the impression that just such a hierarchical sorting process is also an ordeal which new prisoners must undergo when arriving in prison. What's more, I can certainly vouch for the fact that a similar probing process awaits any new students arriving in a classroom where the pecking order is long established.

Finally, (and at this point my lack of actual biological training renders this contention a bit "dicey," because I am projecting and hypothesizing without a real foundation of confirmed biological fact) would not another, smaller but still important focus of mental concern for these animals living in the wild be to assess the performance of their group leader – their "alpha male" or "matriarch" (depending upon the habits of the species), and to assess whether his or her performance continued to justify his or her exalted position, or whether it was perhaps time to consider a replacement?

This image of an almost instinctive, socio-biologically determined imprint governing or at least organizing the vast majority of my students' thoughts, in a manner more *like* than *different* from the patterns one would (hypothetically) find governing the thoughts of wild animals, was striking and compelling for me, not least because it suggested a depth and a "rootedness" in the student "animal" which would go a long way toward explaining some of the otherwise frustrating and counter-intuitive behaviors noted in the introduction. Some might call this too neat a coincidence of the focus of my research and the subsequent interpretation of my data, but I would plead otherwise. In contrast to Nuthall's (1997) belief that how "the classroom is likely to be one of the major sites in which the students acquire and develop those cognitive processes that are the basis of knowledge acquisition," what seemed to be suggested to me was that perhaps students were walking *into* the classroom with patterns of mental self-talk which were almost animalistic in their rooted, instinctive simplicity, and which classroom teachers then had to confront as a more-or-less non-negotiable constraining factor.

As I turned this theory over in my mind, some compelling educational anecdotes from my own experiences as a student and as a teacher came to mind, and they seemed able to offer substantial support for the apparent validity of the theory. The

reader may judge for his or her self, but I would suggest that this was perhaps an example of my "human-as-instrument" responding usefully to what I was unearthing in the research.

The single best teacher I can remember having was an English teacher at an all-boys boarding school I attended for the last two years of high school. He was a rare bird – eccentric, provocative, and at once gentle yet intentionally rude and offensive (for comic effect). His normal classroom routine was heavily dependent on the most high-powered male jostling and banter I have ever experienced. Profanity and ethnic slurs were commonplace. His opening line for a discussion of the character of Shylock in *The Merchant of Venice* might be to turn to a particular Jewish student with whom he had a close relationship and say, "Why don't we ask THE JEW about this?" Before the politically correct sensibilities of 1999 start blustering about the unthinkable violations which such teaching perpetrated upon tender student sensibilities, be aware that he invited (and in fact demanded) that he receive at least as good from the students as he dished out to them. For example, the Jewish student's response to such an overture would be something along the lines of, "Shut up, you little humpbacked faggot," if he could not muster any wittier riposte. The banter would continue, pulling the entire class into an absolutely singular blend of hilarity and brilliant insight into literature.

I recognize that this qualifies, certainly, as a classic "You had to be there" experience, and I do not offer this with any expectation that a reader uninitiated in the madcap peculiarities of the climate at an all-boys boarding school can really understand it. The importance of this anecdote is that while I was laughing wildly (along with every other student in the room), I was also taking furious notes on some of the most penetrating teaching I can ever remember experiencing. I went from that school to four

years at an exalted Ivy League university, but the year I spent in his classroom eclipsed any educational experience I had in college, by far.

Until the present moment, I had never really tried to analyze *why* his teaching stood out so vividly in my memory; I simply assumed that it was a function of the uniqueness (and hilarity) of his approach. But, this present research cast my memory of his teaching in a whole new light. In view of my findings about the primacy of the "threat assessment" thought pattern in students' mental processes, is it possible that one key to his singular success as a teacher was not so much the humor itself, but rather *that he was providing us with a vivid psychodrama "threat" on which our innate socio-biological threat-assessment mechanism could focus, thereby freeing the subject matter of the course from having to carry (and inevitably sink beneath the weight of) that burden?* In addition, once you accept the possible existence of such a socio-biological imperative, one might also view our pleasure as students in his classroom as partly a function of our pleasure at having someone truly understand (at a level far beyond what normal, "polite" classroom demeanor would permit) some of the forces and drives within us.

Such a possibility might seem remote, but it was further strengthened when I reconsidered my "second-best teacher" memory -- this time, a French teacher at the same boarding school. This teacher's French classes never reached anything like the level of hilarity which my English teacher's classes maintained as a normal daily routine. But, his teaching style *also acted out an explicit "threat" theme, in comic terms.* He used to make exaggerated faces and point to students he was calling upon with serio-comic intensity. It was remarkably effective at maintaining our attention and engagement. Here again, one might object that humor of any sort is always an effective communications tool, and further that humor in an all-male environment might

naturally tend in the direction of jostling and trash-talking. But, the possibility that the success of these two teachers might in fact have relied upon their ability to key in to a deep-seated socio-biological "threat-assessment" mechanism in their students is an intriguing one, to say the least.

An additional anecdote offers further potential support for this working hypothesis (although it too could be explained away in alternative terms). Recently, well after I began thinking about the research project in light of the above hypothesis, I found myself in front of my English class teaching a dry lesson on the number (singular or plural) of indefinite pronouns and its effect on the choice of the correct possessive pronoun. As I watched with growing dismay the mounting vapidness of the faces in front of me, a voice in my head whispered, "Give them an explicit 'threat' in the classroom environment which they can key into." Consequently, I went into a sort of Mafia-thug patter in the manner of the character portrayed by Joe Pesci in the film *My Cousin Vinny*. As I called on student after student (many of whom had already demonstrated near-total disinterest in and disconnection from the subject of the lesson when I had presented it conventionally), I began improvising lines such as, "You bettah tell me which verb this pronoun is directly receiving the action of right now, or you gonna be receiving the action of MY verb!" etc.

The students came to life immediately and electrically. They were fascinated, and insisted that I play out more and more of the characterization. *At the same time, they did their level best to actually answer correctly the highly complex and unfamiliar grammar exercises which we were facing.* What's more, in the periods that followed other students not even in the room at the time came up to me and begged me to "do the *Cousin Vinny* thing." Admittedly, such student response could also be explained in terms of simple pleasure at having a "movie" come to life in front of them, shock and

surprise at seeing their teacher ham it up so effectively, or just plain old enjoyment of a humorous interlude. But, the way in which this incident contains thematic strands which so directly echo those of my memories of stellar boarding school teaching is provocative, to say the least.

All three of the above anecdotes relate to the first propositional statement, which represents the largest category of student responses (*Threat Assessment*). An additional anecdote also came to mind in connection with the second propositional statement concerning student preoccupation with their hierarchical position in their peer group [the "*How Am I Doing?*" factor].

I had served on a strategic planning committee for Hamilton Park. Its mandate was to come with ways to build student sensitivity to others' needs in the community. The committee chose to refer to this as "citizenship." As we discussed this in committee, it struck me that we were essentially talking about a lesson plan for which the objective was just as unappetizing to students as the typical math lesson's objective. In other words, students would most likely respond to "building their sensitivity to others' needs" with the same vast disinterest with which they respond to "calculating the least common multiple of two numbers." Consequently, it was clear to me that we were facing the same motivational challenges regarding the "citizenship" program as we faced daily in the classroom as subject-area teachers.

Perhaps because we had focused on the word "citizenship," my own brief childhood experience in the Cub Scouts came to mind, and something struck me forcefully. The entire scouting program – an international success of almost 100 years standing – could be viewed as a "lesson plan" with objectives which (although usually more "fun" than traditional academic lesson objectives) often include other, less-than-high-probability activities which scouts must master in order to proceed through the

program. I can vividly remember paging through my "Wolf" badge guidebook as a fourth grader, looking at the 25 to 30 different activities which I had to perform in order to move up to Wolf status. Almost none of the activities held the least bit of intrinsic interest for me. Yet, there I was, participating fully, page after page, activity after activity, in eager pursuit of that Wolf badge.

In light of this current research, I would suggest that what may have been motivating me (aside from general desire to participate in the same activity with my peers) was the same pattern of self-talk which my working hypothesis suggests is the cause for the second-largest group of student math journal thoughts – concern with status within the peer group hierarchy. As a Cub Scout, I worked hard to grasp the next rung on the hierarchical ladder of scouting achievement *even though the activities required in order to do so were ones which I would otherwise have been extremely unlikely to engage in*. Quite simply, I wanted to be able to wear that "Wolf" badge. I wanted my peer group to see that badge when they looked at me in my uniform. The activities which the badge represented meant next to nothing to me. *But the badge itself meant a great deal.*

The implications of this realization to me as a teacher struggling daily with issues of student motivation seem quite important. My professional responsibility as a teacher is to find ways to motivate students to participate in activities which most frequently hold almost no intrinsic interest for them. I put this theory to the test in my math class one day when I was handing back a quiz on adding and subtracting mixed numbers. I had created a small, relatively undistinguished poster on white construction paper with a couple of magic markers. At the top of the poster were the words "Adding and Subtracting Mixed Numbers." Beneath it was the subheading "Certified," followed by the names of the students who had gotten a grade of 90 or higher. Beneath that

was the subheading "Honorable Mention," followed by the names of students who had gotten a grade of 85-89. I put gold stars next to the "Certified" names and silver stars next to the "Honorable Mention" names. There was nothing glamorous or spiffy about the poster (with the possible exception of the stick-on metallic stars). It was clearly a quickly-lettered, makeshift affair. But, the effect it produced on the students when I mounted it on a class bulletin board was electric. The room was instantly abuzz with questions like:

"How can I get on that poster?"

"Can we take another quiz, and will that get me on the poster?"

"Can we do this for every quiz?"

"Can we do this for homework grades, too?"

What's more, student questions in this general vein continued for the next several days, and every time I handed back another quiz for the next several weeks. Keep in mind the fact that this was my hard-to-motivate, "low" math class, and that the pattern of student response to the normal classroom drill of simply handing back quizzes with a grade on top of the paper was invariably a blend of desultory comments like, "Oh, I got an 85," on the one hand, and students getting poor grades simply stuffing the papers into their desks with a display of either feigned or genuine indifference, on the other. Here, instead, I had the "excluded" lower achievers clamoring to find out how they could get their names on the high-achievers' poster. The difference could not have been more striking, both in terms of objectively observable student behaviors and my more subjective reading of the class's general mood or climate. As with the Wolf badge in my Cub Scout experience, the badge – with its ability to publicly impart higher status – held considerable social value even though the class content skills which it represented had almost no social value at all.

In short, then, if I were to integrate these three propositions into one, all-encompassing outcome proposition and state it together with its supporting subsidiary propositions, it would read as follows:

The large majority of student thoughts in the classroom setting tend to place little or no primary mental focus on the material being studied, to such a degree that planning lessons based on even the implicit or partial assumption that students' mental activity is focused on the content per se may be contra-indicated in the extreme. Supporting data include the following:

- 1) Students' most frequent in-class thought pattern [41%] is an assessment of the level of "threat" which the subject matter represents to them, articulated primarily in terms of whether it appears "hard" or "easy."*
- 2) Students' second-most-frequent in-class thought pattern [32%] is an assessment of their own status and performance within their peer group.*
- 3) Students' third-most-frequent in-class thought pattern [19%] is an assessment of the job performance of their group leader [teacher].*
- 4) Students' least frequent in-class thought pattern [7%] is cause/effect analysis and higher order thinking related to aspects of work done in class.*

Teaching effectiveness might substantially improve if lessons were planned to reflect this pattern of self-talk and thought, in contrast to the present prevailing instructional habit of assuming substantial student willingness to focus on the academic content per se.

IMPLICATIONS

To revisit Smolucha (1993) for a moment, he notes that:

...the existence of inner speech and its influence upon patterns of thinking have been widely acknowledged as critical features in

several therapeutic modes...dysfunctional patterns of inner speech (i.e., the "scripts" addressed in cognitive therapy) have been implicated as playing a significant role in the formation of dysfunctional patterns of behavior.

Here he acknowledges the impact of self-talk upon the shape and direction of both thought and behavior, with particular regard to what is considered dysfunctional. Regardless of whether one thinks of the thought patterns which came to light in this research as determining factors or as themselves determined by other factors (the classroom environment, for example), either way they must play a critical role in pedagogy. If one treats the patterns of thought which the research reveals as a sort of biologically determined imprint *not* amenable to substantial alteration, then one must still plumb its depths in order to understand the mandates and limitations which it imposes upon student cognition and the learning process. If, on the other hand, one chooses to view the observed thought patterns as effects rather than causes, an extensive understanding of the dimensions of those patterns remains critical to any serious effort to change them, along with the behaviors which those thought patterns themselves control.

As noted previously, Nuthall (1997) supports the view that the observed patterns should be treated as malleable effects rather than key determining factors:

There is increasing empirical and theoretical support for the view that the processes that constitute the mind are socially and culturally constructed(cf. Cobb & Yackel, 1996; Fernyhough, 1996; John-Steiner & Mahn, 1996; Nelson, 1993, 1996).

In the same piece, he also highlights the danger that without a solid understanding of the processes governing students' minds:

...attempts to 'reform' teaching and the management of students' classroom experiences may focus on the irrelevant and the trivial and leave untouched those aspects that have the most profound and long-term effects on students' intellectual development. (Nuthall, 1997)

Although he is focusing on other aspects of such a danger, I restate his point here because it seems well suited to emphasizing one of the main questions raised by the research data. Many mainstream progressive educators would probably tend to view these research findings merely as additional grains of sad yet unsurprising proof of the dysfunctional, stultifying state of our current educational apparatus. Such a view might be expressed as, *"Look at that! The students are so busy managing oppressive classroom threats, fearing for their egos and dodging bullets from the teacher that they can't even connect with the material!"* I would surmise that such an interpretation would be considered non-controversial and would tend to meet with widespread support.

Yet, such is not the interpretation which seems most compelling to me. Far more interesting and potentially powerful would be the alternative view which I am trying to articulate. What if, far from being some undesirable and unintended outcome resulting from oppressive or unimaginative teaching, curriculum or administration, the patterns of student thoughts which the research brought to light are in fact an expression of a biologically determined, imprinted pattern which is something of a "default setting" for the human animal, unless that animal has received the substantial training and/or developed the self-discipline required to move beyond such a level?

Such a supposition would completely change the analysis and implications of the findings. Now, instead of the research findings simply providing one more proof of how poorly we are serving the development of our students' thinking abilities, the findings instead become something of a clarion call stating, *"There is a subtextual structure governing students thoughts which you can either ignore in favor of your pedagogues' fantasy as to what you wish they were thinking, or you can face up to the truth, understand it, accept it, and start ministering to it in your classroom climate, your*

lesson plans and your interactions with the students. If you do accept it and learn to teach to it and through it, you may find that instead of watching it silently defeat your best efforts from its unacknowledged yet privileged and powerful position "backstage" in the students' minds, you can begin to actually harness it and use it in pursuit of your educational objectives for the students."

As for whether the structure of students' thoughts revealed by the research might be readily amenable to change, I would note that even if such change should prove *not* feasible, standard developmentally aware teaching practice would call for identifying the governing internal developmental mandates which it imposed and *tailoring lessons to those mandates*. Clearly, even if we consider the observed self-talk and thought structures as innate rather than conditioned, and thus more predetermined than malleable, one would be obliged to teach *to* such structures rather than continue teaching to the perhaps mythical "intrinsically interested" student with whom we educators people our classrooms, in our imaginations if nowhere else. If we instead follow more of Smolucha and Nuthall's view of such structures as malleable and amenable to change in response to variable classroom factors, etc., then one can still only begin to approach such a process of change and development by gaining a solid understanding of its architecture.

To follow the "innate, imprinted" line of analysis for a moment, consider the task of training a group of animals to perform specific tasks which they are not particularly desirous of mastering. Additionally, suppose this to be a species of animal which is known to devote its mental and communicative energy almost entirely to the tasks of threat assessment, hierarchical status assessment and group leader assessment. If so, it would be only natural for the "trainers" involved to take respectful account of the effects of such habits of thought upon the "trainees."

Any effective "lesson plan" for the animals would – if it were intelligent and perceptive – show due respect for the fact that animals were deeply entrenched in their long-standing habits of cognition. Furthermore, there would probably be considerable consensus among the "trainer" community that to approach the task of training *without* such respect would at best be a highly inefficient way to approach the training task. What's more, a truly effective trainer would probably try to harness and rely upon the existing structure of the animals' cognitive habits to achieve his or her teaching goals. This might be most simply achieved by finding a means of getting the "students" to incorporate and integrate the targeted lesson objective into the rhythms of one of their accustomed assessment activities – be it threat, hierarchy or leadership.

No successful trainer would ever ignore the impact of such a cognitive imprint. To do so would be to "ignore the way they learn." A trainer would be even less likely to try and *force* his or her way through such mental patterns, or to set out on the Quixotic pursuit of trying and break them down and replace them with altogether different structures more amenable to the trainer's objectives.

Perhaps the most compelling question which arose from the research finding was, simply, this: *"To what degree might the same cognitive structure which so demonstrably seems to govern the students' in-class thought processes also perhaps govern my own thoughts as their teacher?"* An answer of "Yes, to a substantial degree" could serve to substantially strengthen the trustworthiness of the findings, particularly the component of the analysis suggesting that we might be dealing with a deeply imprinted socio-biological set of thought patterns. If I could sincerely discern the same thought patterns governing and organizing my own in-class mental activities, the plausibility of such a contention could only be increased considerably. When this

question first occurred to me, deep into the outcome analysis, the answer came quickly and with compelling force.

Question One: *What is the largest single classification of mental activity coursing through my thoughts in the course of the average class session?*

Answer: I scan the classroom constantly (more than once every minute) searching for signs of inattention and disengagement. It would certainly be fair to say that I consider such attitudes displayed by students as a substantial "threat" on my horizon, and that for me to scan that horizon constantly for fear that such will appear is a very concrete form of "threat assessment" on my part. And this is the largest single classification of thought coursing through my mind during a class. *"Are they paying attention? Are they getting it? Who's ignoring the lesson? Who's causing a distraction? Who's going to need extra help because they're blowing off the basics?"* In short, my own thoughts track the students' to a tee. For students, the biggest "threat" consists of the amount and the difficulty of assigned work. For this teacher, the biggest "threat" consists of the danger that students will fail to master the work. In both cases, assessing the level of the threat constitutes the largest single category of mental activity in which we apparently engage.

Question Two: *What would be the second-largest classification of observable in-class thoughts for me as a teacher?* Answer: Most probably, it would be thoughts in which I am essentially dealing with how closely (in my mind's eye) I resemble my own vision of an ideal teacher, and whether and how I might be able to justify any shortfall to myself or to the principal, were she to walk in the door at that moment. Here again, the correspondence to the students' thought patterns is striking. The kids' second-largest thought pattern is assessing their place within their peer group hierarchy. It is certainly legitimate to say that the thought-group in my mind about how

high up the ladder of teaching excellence I am reaching at a given moment corresponds very closely to this.

Question Three: *What would be the third-largest classification of my in-class thoughts in the course of a teaching day?* Answer: This would probably be to assess how my performance relates to the measures of what I *must* achieve with the students. These are probably represented by my plan book and text books, my schedule, the rate and breadth of coverage which I am obliged to maintain, the tools with which I feel I have been equipped by the district in order to accomplish all this, the level of support I feel from the administration, etc. All of these things could easily be said (without too much of a stretch, I think) to represent my own "leader." For the students, I am the leader simply by virtue of the fact that I have authority over them and can (to some degree) order them about and determine or limit their choices. This is, essentially, the same role which my curriculum, textbooks, schedule, etc. play in my own life as a teacher. They are my "have to," my authority figure and my boss. I definitely devote considerable mental energy to observing my feelings about their mandates on a daily basis. Here again, the correspondence to the students' thought patterns holds up.

Question Four: *To what degree do I engage in content-based higher-order or critico-creative thinking?* Answer: To a considerably lesser degree than I engage in the above three categories of thought. Such thoughts would definitely be in the smallest minority category, exactly as they are for the students. It would be fascinating to actually track my thoughts and determine whether those which *are* higher-order, content-related or critico-creative are really at as low a level as the seven percent observed among the students.

In conclusion, once I sort all of my thoughts in the course of a day in class into these three main "baskets," how much is left over? Very little. I am not engaged in a substantial amount of content-related thought, seeing connections, creating new approaches, analyzing or free-thinking. My majority presence and function in class might arguably be better described as a "threat articulation and management device." *"We have to do this now. If we don't, we'll all be in trouble. This one isn't too bad. Okay, now we have to do something else. This one is hard. But, I've found a pretty good way to make it easier. Watch out for this danger – it might mess you up, see? Be careful. Here's a way to make it easier. Okay, this next thing is really easy; you can relax pretty much now."*

Clearly, if I ever did record my thoughts in class, the largest part would relate to threat assessment. The next-largest grouping would relate to the way I assigned and maintained hierarchical rankings within my class – chastising some, rewarding others, trying to affirm and maintain my own personal hierarchy based upon criteria I had established. With these two major concerns taken care of, I am likely to heave a sigh of relief and assess the degree to which what I've been asked to do (that period, that day, that week) feels reasonable or not. If it's been a good day, my assessment is *"Sure, everything's fine for now."* If it's been a struggle, the assessment takes the form, *"God, it's impossible! No one can expect me to achieve what they expect me to achieve! The leadership needs to get itself together!"*

In short, my own thought patterns here would seem to parallel the students' rather closely, which tends to further support the notion that perhaps we are dealing with a socio-biologically determined imprint. Alternatively, a skeptical reader might raise the question of whether perhaps the thought patterns displayed by my students

are quite simply a function of the fact that they are sitting in *my* classroom, and that these are the patterns of *my* thoughts. It would be fascinating to pursue this further. Perhaps the final question which should be discussed at this point in the report is, "Okay, supposing you're right and there is something socio-biological going on here in the students' thought patterns that we need to address as educators. How would you go about doing it, specifically? Show me a lesson plan or some classroom management strategies!" Here goes:

- 1) HIERARCHY: Assume the need for extrinsically-based motivators (such as the "Certified") posters) which would tie in to the students' theoretical need to constantly assess their hierarchical status. This could eventually be worked into as elaborate a scheme as limitations on management time and energy would permit. This is not to say that as an educator I would stop looking for intrinsic motivation in the students, but simply that I would expect to find a lot more of it if I properly addressed their apparent imprinted need for extrinsic motivational support first.
- 2) THREAT: As for the threat assessment mechanism, this is trickier. The simplest answer might consist of an old-fashioned "Don't smile until November" psychological manipulation. But this is not really to the point, because what seems to be called for is a threat into which their innate threat-assessment mechanism could "plug" which is *separate and distinct from the content of the course*. Perhaps the answer lies in combining this somehow with the concern for hierarchical placement. A mechanism could be devised by which students were at risk of losing some "step" on the extrinsic recognition system if... I don't know. I am feeling my way, at this early point in my efforts.

- 3) LEADERSHIP: I don't know if there is anything to be done here. Could perhaps something be devised with a student spokesperson or advocate who had particular privileges not available to other students? If such a "title" were linked to achieving a specific status within the hierarchical recognition system, it could tie together nicely. For example, the designated advocate could be permitted to question and challenge classroom practices or assignments which the rank and file of students could not. The possibilities might be intriguing.

Suggestions for Further Research and Conclusion

Perhaps the most compelling need for further research suggested by the project's findings is to expand it so that it encompasses a broader number and variety of subject areas and student types, in an effort to ascertain whether the patterns of cognition which were so evident in the present, limited study sustain themselves throughout a broader effort. Much of the analysis afforded by the results I did achieve is fascinating and compelling, but before proceeding any further with it, I would be well advised to try and strengthen the foundational empirical observations upon which it is based.

In addition, a critical reader might perhaps be struck by the parallels between the wording of my opening remarks to the students as to the purpose of the math journals and the data which I eventually extracted from them. For example, in my opening remarks, my instructions to the students included the following:

If you are enjoying something, write down what you think. If you think something is stupid and you hate it, write that down too. If you think I am doing a good job, write that down. If you think I'm being the worst math teacher in the world, write that down too.

The criticism could legitimately be raised here that, in a sense, my instructions to the students were, "Assess the threat posed by the work, and assess my performance as

group leader," thereby making my research "findings" something of a foregone conclusion.

Although I acknowledge the legitimacy of this criticism, my answer would be first that when I gave those instructions I had not yet formed any conscious thought of an organizational scheme for the data – in fact, I had no data yet. Secondly, the wording in question could be excused as a fairly commonplace description of high-probability student thoughts. However, the criticism is certainly valid, and the trustworthiness of any further research I undertake on this question will be enhanced if I am more judicious and intentionally "content-neutral" in the wording of my instructions to the students.

With regard to my musings that perhaps my two boarding school teachers were so effective as educators because they provided their students with explicit "threats" in their classroom environments onto which students' threat-assessment mechanism could "hook," thereby freeing up the subject matter of the course from carrying that debilitating psychodynamic burden, it brings to mind an intriguing possibility for further research. One might pursue a student polling mechanism in different school districts to identify which teachers the students deemed the most "powerful" or "effective" as educators. Observations of those teachers' lessons might conceivably offer further support for my notion that perhaps some explicit, "substitute threat" present in such signally effective teachers' class climates serves a powerful beneficial pedagogical role. Alternatively, the same group of students could be tested with a variety of lesson plans – some containing an explicit "threat" component and some not – to see whether a pattern of better student engagement and consequent skill mastery emerged.

Additionally (with regard to the second propositional statement relating to peer-group hierarchy), if my teaching partner and I were to fully implement a program of

extrinsic, hierarchy-based symbolic motivators (along the lines of scouting's badge system), we could easily compare the standardized test scores of students finishing a year of work under such a regimen with the scores of previous students finishing a year under our previous, "normal" classroom procedures. A noticeable improvement of one over the other would provide concrete, quantitative support for the working hypothesis.

One further potential area for further research would be to try and record the progress and classification of my own thoughts as I taught, perhaps with a pocket dictaphone. Doing so would be tricky, but could provide further support for the critical contention that at least the rough outlines of the thought classifications which prevailed in the students' minds are present and operative in my own as well.

Along the same lines, it might be interesting (were I ever able to publish my findings in a professional journal) to solicit input from other educators as to whether my rough assessment of the students and my own categories of thought matched their own intuitions and experiences.

In conclusion, it seems appropriate to note that slightly less than a year before undertaking this research, I read Monty Roberts's book, *The Man Who Listens to Horses*, and knew intuitively that what he had discovered about horses had some great potential connection to my work as a teacher. Raised to "break" horses to the saddle in the traditional brutal manner by his father, Monty as a boy used to take refuge in mountain canyons where he would secretly observe herds of wild mustangs for days at a time. There, he was eventually able to discern patterns in their communication (particularly in the communication of the dominant matriarch toward unruly young stallions) which unlocked the world of the horses' thought to him.

Utilizing his discovery, he developed a "lesson plan" for breaking horses (although he refuses to call it this) which plugs directly into these patterns and

preoccupations within the horses' minds. His result: a spectacularly successful ability to "break" a horse to the saddle in approximately twenty minutes, in contrast to the hours of fear and oppression called for by the traditional approach. His resultant fame within equestrian circles has become so great that he has worked repeatedly for the Queen of England.

If, as I would like to believe, I have perhaps stumbled upon a potentially important discovery in this research, it may be analogous to what Roberts discovered about his mustangs. The degree to which his understanding of the horses' thought patterns allowed him to enter powerfully into their cognition permitted him to "achieve his lesson objectives" with an efficiency previously unheard of in the world of horsemanship. If what I have sketched out in this preliminary research should prove genuine and reproducible, it might perhaps serve a similar purpose in the hands of educators who could devise ways to achieve their lesson objectives without the inefficiency and "thrashing about" which seems to afflict so much current education (including my own best efforts). This is my hope, and this will continue to be my ongoing process of inquiry and investigation as I feel my way further into the future.

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